# Chapter 4

Water
Design Standards and Policies
Revised December 1999

**Chapter 4, Potable Water System Design**, provides guidance and minimum design criteria for the modification and construction of the water systems owned and operated by the City of Scottsdale.

# Section 4.1

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FIGURES LIST

# SECTION 4.1
# POTABLE WATER SYSTEM DESIGN

## SECTION 4-100 GENERAL COMMENTS

This document provides guidance and minimum design criteria for the modification and construction of the water systems owned and operated by the City of Scottsdale. It is intended for use in the planning, design and planning preparation processes.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY REQUIREMENTS.
Engineering Bulletin #10, “Guidelines for the Construction of Water Systems”, and, Engineering Bulletin #11 “Minimum Requirements for Design, Submission of Plans, and Specifications of Sewerage Works” published by the Arizona Department of Environmental Quality, contain specific requirements for submittals, approvals, and notifications. It shall be the responsibility of the developer to comply with these regulations and requirements.

a. Prior to submitting Final Plans for City Approval, the developer shall provide "Certificate of Approval to Construct Water and/or Wastewater Systems”. This approval is provided by the Maricopa County Environmental Services Department and shall appear on the cover sheet of the improvement plans.

b. Prior to performing inspections, the developer shall submit evidence that “Notification of Starting Construction” has been submitted to the Maricopa County Environmental Services Department. This evidence will be on a document developed and date stamped by the County.

c. Prior to issuing a Letter of Acceptance, the developer will provide the Maricopa County Environmental Services Department the following documents:

   - The Engineers Certificate of Completion with all test results, analysis results, and calculations as indicated on the form.
   - A "Request for Certificate of Approval of Construction" of Water/sewer Lines with all appropriate quantities and As-Built for the facility when field changes have occurred which modify the approved plans.

d. The developer shall then provide the City's Inspection Services Division with a "Certificate of Approval of Construction" signed by the Maricopa County Environmental Services Department and a copy of the As-Built drawings.

## A. ORDINANCE REQUIREMENTS

The developer shall install, at his/her expense, all on-site improvements necessary to service the development. This may include pump stations, reservoirs, transmission mains, pressure reducing valves and other facilities necessary to service the development. This includes payment of all required development fees. The City may elect to participate in the cost of oversizing of any pipeline in accordance with City ordinance requirements. See Section D. Oversizing, Page 2 of this section for more detail.

Each lot in a subdivision shall be supplied with a safe, reliable and potable water in a sufficient volume and pressure for domestic use and fire protection. This shall be verified by the Engineer by performing a flow and pressure test of that part of the potable system to be extended. The flows and pressure must meet minimum requirements for domestic and fire flow requirements. This shall be verified on the cover sheet of the plans by the Engineer. See Sections C (Pressure Requirements) and D (Design Flows) in Section 4-102 in the Distribution System section.

If the residence is to be supplied with domestic service and with fire flows from a storage tank of facility, the engineer must provide a report indicating that sufficient volumes exist as required by Rural-Metro Corporation and are available to meet calculated fire demands as defined by the engineer.

Upon development of the property for which City water and/or sewer is desired and available, the developer shall submit a plan for the water and/or sewer system prepared by a professional engineer licensed in the State of Arizona.

The City requires water mains to be installed along the entire length of the property line frontage of the property to be developed, where future extension of the line is possible. The property line frontage is that portion of the property along a public right-of-way and/or public utility easement. If a parcel to be developed has more than one frontage, the City shall also require improvements to be installed the entire frontage(s).

For current information on ordinance requirements, review of Chapter 48 (Subdivisions) and Chapter 49 (Water, Sewer and Sewerage Disposal) of the Scottsdale Revised Code is recommended.

## B. CITY POLICY

Proposed developments determined by the City to have strong impact on the water system shall be analyzed on the current City's Master Plan computer model at the developer's expense. The effects of peak and fire flows from these developments will be examined to ensure proper sizing and layout of proposed water system facilities to meet the demands imposed by large-scale developments. Please contact the Water Resources Department at 391-5685 for more information.

## C. REIMBURSEMENT AGREEMENTS

There is established a program for extension of City water and sewer systems to newly developed areas and subdivisions inside the City's service area for which City water or sewer service is desired and available. This program provides for reimbursement agreements with

developers and property owners and for the collection of line reimbursement charges. The elements of the extension policy and program are set forth in Article V of Chapter 49 (Water, Sewer and Sewage Disposal) of the Scottsdale Revised Code and shall apply to all extensions of the City water and sewer systems.

Reimbursement Agreements are set up through the City's Project Review Department. Please contact the Project Review Department at 994-7080 for more details on procedures to initiate the agreement.

## D. OVERSIZING

Oversizing of water and sewer lines may be required by the City. Article V of Chapter 49 (Water, Sewer and Sewage Disposal) of the Scottsdale Revised Code provides for such oversizings and specifics that the City may participate in the cost of oversizing, provided there are sufficient funds in the Capital Improvements budget.

Oversizing typically occurs where water or sewer extensions are proposed on mile and half mile (section and mid-section line) streets, or areas with projected future growth. All oversizing projects involving City funds must have an oversizing agreement and meet existing City requirements prior to plan approval and construction. Contact the City Water Resources Department at 391-5685 for oversizing agreements and plan & construction requirements.

## E. PRIVATE WATER COMPANIES

Portions of Scottsdale's municipal service area are provided water service by private water companies. Figure 4.1-1 in the Appendix delineates those areas.

Privately owned and maintained water lines shall not be located in the street right-of-way (R.O.W.) or a Public Utility Easement (PUE).

Modifications or construction of water systems within private water company franchise areas should be reviewed by the subject company. The City cannot provide water service within private water company franchise areas. Scottsdale will not review private water systems unless requested by the owner, except for fire protection systems. In cases where the City of Scottsdale is requested to review private water systems, the applicable review fees must be paid and a note placed on the drawing delineating operation and maintenance responsibilities.

## F. DESIGN REPORTS

A design report memorandum shall be required. The design report shall present necessary information concerning:

- design assumptions & computations
- demands
- pressures and flows
- cathodic requirements
- right-of-ways or easement that are being provided

The objective of the report is to provide sufficient background information to adequately review the project.

## G. **MASTER PLANS**

A copy of the accepted, signed Master Plan shall be submitted when final civil plans are submitted.

When required by the City, a Master Water Plan and Report shall be prepared in accordance with the City's Design Standards and Policies Manual by a professional engineer registered in and licensed to practice in the State of Arizona. The master plan report shall address, but not be limited to the following:

1. The Master Plan will become the basis for a Water and Wastewater Service Agreement between the developer and the City of Scottsdale when such agreement is required by the City. This agreement will specify terms and requirements for water and wastewater service to the development. The introduction to the report should state this.
2. All development projects shall be responsible for determining their specific water system needs and include surrounding developments to ensure there is no strain on the system. Service for proposed developments shall not be provided at the expense of existing customers and the water master plan shall verify this.
3. A computer water network model, using the EPANET or H20NET program, for the analysis of pressure and flows in pipe distribution systems, shall verify that adequate pressures and flows will be available within the development. In addition, if certified flow tests performed on the system which the project is to be connected do not show that sufficient capacity exists, the computer model shall be used to determine the required on-site and off-site facilities such as pump stations and pipelines necessary to serve the project. If the proposed development requires a change in zoning which increases density or proposes a water system different from the City's existing Water Master Plan, then additional off-site calculations will be required. All model data shall include the following:

3.

- Demands shall be calculated according to densities shown in Figure 4.1-3, Average Day Water Demands per Dwelling Unit.
- The system shall provide maximum day demands (2.0 times average day demand) plus fire flow. The fire flow used in all calculations should be 500 gpm residential and 1,500 gpm multi-family and commercial per Fire Code.
- Verification of the ability to provide peak hour demands (3.5 times average day demands) shall be provided.
- The minimum required pressure throughout the water distribution system is 50 psi at the highest finished floor elevation. A residual pressure of 30 psi is allowed under fire flow conditions
- Pipe line calculations shall verify that head loss per one thousand (1,000) feet of any pipe shall not be more than ten (10) ft/ft during peak period demand conditions and not more than eight (8) ft/ft under any maximum day conditions.
- Sufficient supply for demand must be provided without the use of dedicated fire pumps or back-up pumps. Calculations which include both domestic demand plus fire flow may use fire pumps as a portion of the supply.
- A computer disk containing all calculations shall be submitted along with the Master Plan report.

4. Each Master Plan map must show the following:

    - All proposed on-site and off-site facilities including, but not limited to, pump stations, transmission and distribution mains and reservoirs.
    - Proposed street locations, parcel boundaries and proposed lots within each parcel.
    - Contour lines at two foot intervals showing the elevation of the land surface. Sufficient information must be provided to evaluate network node elevations.
    - All pressure zone boundaries, (see figure 4.1-2), Pressure Reducing Valves (PRV's) (showing pressure differentials) and corresponding zone valves.
    - P.R.V. size and pressure settings shall be indicated on the plans by the design engineer.
    - A separate area location map shall be provided showing existing and proposed streets, as well as existing parcels surrounding the project to a distance of one mile from the exterior boundaries of the project. Assessor's maps can be provide the information required to prepare these composite maps.
    - The scale of all maps must be sufficient to show all required information clearly.

5. All water lines which cross golf courses or other open areas must do so within established roads. If dedicated roads are not practical, then the crossing must be within twenty (20) foot wide accessible easement within a tract. No walls shall cross these easements.
6. The Water Master Plan must show compliance with Section 49-199 of the Scottsdale Revised Code to construct pipeline, if not already in place, across all dedicated frontages of the development.
7. A construction schedule shall be included in a table format for all water related construction required to serve the development. The schedule shall have each phase or parcel as column headings and each construction project or system component as right-of-way (ROW) headings. A mark in each box shall specify when each constructed item will be required for each phase of the development.
8. Compliance with the adopted City Water System Master Plan encompassing the respective area.
9. Those Master Planned Developments that design a distribution system that will be phased shall provide a synopsis of the phasing to the Water Production Division of the Water Resources Department upon acceptance of the Water Master Plan.

More specific information regarding water plan requirements and/or the City's current Water System Master Plan, please contact the City of Scottsdale's Water Resources Department at 391-5685.

## 4-101 PRODUCTION SYSTEMS

**A.** Unless otherwise agreed to in writing by the City Asset Management Coordinator, each tract or lot dedicated to the city shall be: (1) conveyed by a general warranty deed, and (2) accompanied by a title policy in favor of the City, both to the satisfaction of City staff as designated by the Asset Management Coordinator.

### B. WELLS

The City shall be notified of any proposed well drilling and review plans of all proposed groundwater wells. Under the Arizona Groundwater Management Code, the Arizona Department of Water Resources (ADWR) regulates all groundwater wells in Arizona. Before drilling and installing a well, a "Notice of Intent to Drill" and "Application for a Drilling Permit" must be obtained from and filed with ADWR. The well must subsequently be registered with ADWR. Forms and additional information are available from ADWR Operations Division, phone 542-1581.

### B. RESERVOIRS

Storage facilities must provide emergency fire protection and maximize the use of water production facilities. Therefore, storage in each pressure zone shall exceed each of the following criteria.

- Three hours fire flows reserve + 25% of maximum day demand, or;
- One average day demand

### C. BOOSTER PUMP STATIONS

Booster pumps shall be designed and required to maintain adequate pressure for domestic and fire protection water supply. City of Scottsdale pump system criteria and details are available at the Water Production Division of the Water Resources Department at 391-5650. All stations shall provide at a minimum, chlorination equipment, variable frequency drive pumps, backup power supply and telemetry compatible with the Water Resources Department current system. Designers shall refer to Engineering Bulletin No. 10 by the Arizona Department of Health Services for additional design criteria.

A preliminary or basis of design report shall be prepared and submitted to the City for acceptance prior to final design. This report shall outline the type of equipment and controls proposed for the station. A final design report prepared by a registered professional engineer licensed in Arizona must accompany all pump station design drawing.

### D. PRESSURE REDUCING VALVES

Reference figure 4.1-2 for determining pressure zone boundaries. Pressure Reducing Valves (PRV's) shall be required to maintain pressures within the distribution system. Distribution systems shall not be designed to operate at pressures in excess of one hundred-twenty (120) pounds per square inch (psi). PRV's shall be designed in accordance with the criteria delineated in City of Scottsdale Supplemental Detail No. 2342-1 and 2342-2.

The City of Scottsdale operates its system from wells and pumps that commonly have pressures exceeding 80 psi. Changes in demand, supply and the distribution system also vary the pressure at single family residences.

The City requires all buildings to have a PRV installed on the service line. A written variance request may be submitted to Water Resources for their review and concurrence or denial. The Uniform Plumbing Code requires a pressure regulator when local water pressure exceeds 80 psi.

## 4-102 DISTRIBUTION SYSTEMS

The Water Distribution System owned by the City of Scottsdale operates on a grid system. This grid shall consist of water mains sized as follows unless otherwise approved by the Water Resources Director or his designee.

Mile and half-mile alignments shall be minimum twelve (12) inch.
Quarter mile alignments shall be minimum eight (8) inch.
Water lines located in the county shall be a minimum eight (8) inch.
All other frontages shall be minimum six (6) inch.

Water mains shall be extended across all frontages upon development of a property if an approved source is within six hundred sixty (660) feet.

When lines 12 inch or larger are required, the City may participate in the cost of oversizing. All water lines shall be sized per the adopted City Master Plan and as such may require changes in required water line sizes.

### A. SYSTEM LAYOUT

Hydrants, meters, blow-offs and valves shall not be located in washes, detention / retention areas, driveways or sidewalks. All existing water services and or appurtenances shall be utilized by the development or abandoned by disconnecting at the main. In general, tees shall be removed and replaced with an appropriate pipe section. Services shall be excavated at the main and isolated and abandoned at the corporation stop.

Hydrants shall have depth of burial of three and one-half (3.5) feet.

To provide appropriate water pressures and water circulation, all new water mains shall be designed in a loop configuration as required. See figure 4.1-2 for water pressure zone boundaries.

In general, water lines shall be on the north and east side of the right-of-way, two (2) feet behind the curb, sidewalk, roadway or approved by the Water Resources Department.

All water lines shall be aligned parallel to property lines or street center lines and shall not cross and recross the center line except in cases justifiable to the City. Water lines shall be located in water and/or sewer easements located within tracts and in areas where permanent twenty (20) foot minimum access for maintenance purposes are maintained.

Long, straight reaches of transmission mains shall be marked every 440 feet with an electronic marker. Installation of an electronic marker may be omitted when valve locations permit identification of pipeline location.

All water service lines shall be located within two (2) feet of the property line adjacent to adjoining parcels water service line.

## B. **DESIGN FLOWS**

Design flows for transmission mains shall be based in the current City Master Plan to provide for the water system's ultimate demands. Calculations of the flows for the specified development will be calculated to ensure that the existing supply is sufficient to meet proposed development. All improvements necessary to meet proposed flows to include pumping stations, reservoirs, lines and appurtenances are to be part of the design.

Peak flow calculations on transmission mains shall be based on maximum day flows including fire flow, in accordance with the City of Scottsdale Fire Code. See figure 4.1-3 for average day demand flows.

Design flows for all distribution systems shall be based upon existing flows and pressures as documented by the engineer. The engineer must have a flow test performed by a private company who will certify the results in writing to the city. These flows will be used by the engineer for the design and the design report for all water line projects. These flows and pressures will be stamped on the plans and be submitted to the city. **Prior to acceptance by the City, all platted subdivisions shall conduct an additional flow test at the lowest and highest elevation available in which the development is constructed. Developments that cross pressure zone boundaries shall conduct a flow test in each pressure zone as outlined above. The results of this test with a copy of the improvement plans shall be submitted to the Inspection Services Department for subsequent review by the Water Operations Department. Flow test to be conducted during high water use - 6:00 A.M. to 8:00 A.M.**

## C. **PRESSURE REQUIREMENTS**

Pressure extremes in water systems result in potential for contamination to enter the network. Low pressures in the water system may allow polluted fluids to be forced into the system. High pressures may cause ruptures or breaks in some elements of the network. The normal working pressure in the distribution system should not exceed one hundred-twenty (120) psi.

Domestic systems shall be designed to maintain a minimum residual pressure of fifty (50) psi at the highest finished floor level to be served under all flow conditions. (Minimum pressure for fire protection may differ. See section 4-103.A of this manual.)

All water mains and service lines shall be designed for a minimum normal internal working pressure of one hundred-fifty (150) psi plus appropriate allowance for water hammer.

Water hammer may produce momentary pressures greatly in excess of normal static pressures, thus increasing the probability of water main failure. Suitable provisions shall be made to protect the system from water hammer pressures. The occurrence and severity of water hammer can be reduced through the use of slow-closing valves, pressure-release valves, surge tanks, variable frequency drives, soft start motor controllers and air chambers.

In cases where greater than the above noted maximum pressures are required for effective operation, all elements of the system shall be design accordingly. Pressure information for existing water lines may be obtained by having a flow test performed on the system. These tests shall be performed by a private fire protection company who must certify the results and submit them to the City for approval. Contact the Project Review Division at 994-7080 to

obtain a list of those firms who will provide the flow test which is to be performed at the developer's expense.

An encroachment permit issued by the Development Services Department (994-2500) is necessary to perform the test and the City shall be notified a minimum of forty-eight (48) hours before the test by contacting Water Operations at 391-5650.

## D. **TRACT & EASEMENT REQUIREMENTS**

No water lines shall be installed in an easement unless the Water Resources Department has approved in writing the placement of the line(s) in an easement(s) and the property owner has granted the necessary easement(s) and/or right-of-way.

Water lines outside of public rights-of-way may be placed in twenty (20) foot, minimum width, easement within a dedicated tract, with a minimum of six (6) feet between the water line and the edge of the easement and shall be accessible from a public right-of-way. The easement shall be free of obstructions, shall not be located in a fenced area and shall at all times be accessible to City service equipment such as trucks, backhoes, etc. Areas in question shall be approved in writing by the Water Resources Department.

Abandonment of water and/or sewer easements will adhere to the following criteria.

1. A letter requesting the abandonment of the easement and reason for the abandonment shall be submitted to the Water Resources Department with the following exhibits:

a) Detailed map depicting the easement to be abandoned shall be highlighted and the locations of both water and sewer lines shall be shown in reference to the easement in question.

b) If water and/or sewer lines are to be abandoned, a detailed civil plan prepared by a professional engineer licensed in the State of Arizona must be supplied describing the method of abandonment.

2. A letter will be issued stating approval or denial of the abandonment request, certain stipulations may be required in conjunction with the abandonment, and will be stated in the letter from Water Resources Department.
3. The individual will be responsible for submitting original packet with Water Resources Department decision to the Project Review Department for final approval.

Failure to supply the above noted criteria and exhibits will result in denial of the request.

All existing water services and or appurtenances shall be utilized by the development or abandoned by disconnecting at the main. In general, tees shall be removed and replaced with an appropriate pipe section. Services shall be excavated at the main and isolated and abandoned at the corporation stop.

Water line easements located within tracts shall have a ten (10) foot wide hardened path with a cross-sectional slope not greater than 10%. The hardened path shall consist of native soil with 95% compaction and compacted for a depth of one (1) foot from the surface.

## E. **PIPELINES**

Water distribution lines six (6) inch through twelve (12) inch in diameter shall be asbestos-cement (ACP) or ductile iron (DIP). All ACP and DIP pipe shall be at least Pressure Class 150.

Large diameter pipe - sixteen (16) inch and larger may be DIP, mortar lined steel, steel cylinder pretensioned pipe or a City of Scottsdale approved substitute.

Fire line services (three-inches and larger), and all hydrant connections shall be constructed of ductile iron pipe, minimum Class 150 or equal to or greater than the supply line class. C-900 pipe is acceptable for "Fire Lines" only when on-site of the project. If any water line is under a paved area, DIP will be used.

Ductile iron pipe may be required in cases where pipelines could be subjected to heavy external loads. These include, but are not limited to, deep pipelines and pipelines in the roadway alignment which would be exposed to heavy construction vehicle loads prior to paving. The use of PVC C-900 is prohibited in the City of Scottsdale.

Design specifying installations using ductile iron pipe or any metallic pipe, without wrapping, must address soil corrosivity and shall require testing in accordance procedures of the American Ductile Iron Pipe Research Association to determine corrosiveness of the soil. Such tests shall be submitted to the City with the final plans and specifications to determine if cathodic protection is required in the design. As a minimum, polyethylene protection per AWWA C105 will be used on all ductile iron pipe.

The minimum size water distribution mains allowed in the City of Scottsdale shall be six (6) inches. The minimum size water distribution mains allowed in the County is eight (8) inches.

## F. PIPE COVER & SEPARATIONS

Mains twelve (12) inch in diameter shall have a minimum cover of forty-eight (48) inches over the top of pipe. Mains larger than twelve (12) inches in diameter shall have a minimum cover of sixty (60) inches over the top of pipe. Water mains in industrial areas or in major collectors and arterial streets shall have a minimum of sixty (60) inches over the top of the pipe. In other locations, mains smaller than twelve (12) inches in diameter shall have a cover of thirty-six (36) inches over the top of pipe unless otherwise approved by the City of Scottsdale's Project Review Department. All water lines twelve (12) inches or larger shall be marked with locating tape.

Concrete encasement of any water line is prohibited unless approved by the City of Scottsdale's Water Operations Department.

Cover for water mains shall be measured from existing or proposed finished grade of pavement or natural ground, whichever measurement is greater and results in adequate pipe protection during construction.

Caution should be taken in design and construction to protect all water supplies from wastewater contamination.

When PVC or ACP water lines are exposed during construction and the bedding is disturbed , the water line shall be changed out to ductile iron pipe (minimum Class 150) with mechanical joints or flanged joints.

Where conditions prevent adequate horizontal and vertical separation, both the water and sewer line will be constructed of ductile iron pipe (minimum Class 150) with restrained joints.

Separation of water and electrical or gas lines shall conform to City of Scottsdale Detail #2372.

## G. SHUTOFF VALVES

Shutoff isolation valves shall be installed on water mains at locations within the distribution system which allow sections of the system to be taken out of service for repairs or maintenance without significantly curtailing service in other areas. Special consideration should be given to the number of fire hydrants taken out of service. A sufficient number of valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located such that any section of the system can be isolated by closing no more than four (4) valves.

Maximum spacing of water distribution main isolation valves shall be as follows:

1. In commercial, multi-family and industrial areas, valves shall be located at not more than five hundred (500) foot intervals.
2. In single-family residential areas, valves shall be located at not more than one block or not more than eight hundred (800) foot intervals, whichever is less. In higher density developments, closer spacing may be required.

Maximum spacing of water transmission main isolation valves shall be as follows:

1. At every one mile section line, a cross shall be installed with a valve on each side of the cross.
2. Valves between the main section line shall be located at not more than one thousand three hundred twenty (1,320) feet apart.
3. No valves shall be installed in sidewalks.

Any special spacing must be approved in writing by the City Water Resources Department.

All mains branching from feeder mains or loops should be valved adjacent to the feeders so that the branch mains can be taken out of service without interrupting the supply to other locations. At intersections of distribution mains, the number of valves required will normally be one less than the number of radiating mains; the un-valved branch is usually the line which principally supplies flow to the intersection. Shutoff valves shall be installed in standardized locations so they can easily be found in emergencies. For butterfly shutoff valves sixteen (16) inches or larger in diameter, it shall be required to surround the valve operator or the entire valve with a manhole to allow for repair or replacement. Per City of Scottsdale standard detail #2305, valved by-pass lines are required on all valves sixteen (16) inches or larger in diameter. In important installations and for deep pipe cover, entrance access manholes shall be provided so that the internal valve parts can be serviced.

Valving shall be provided to allow isolation of lines crossing major washes, railroads, major highways, bridges and airports. A valve shall be provided on each hydrant branch.

Resilient wedge gate valves are required for all valves twelve (12) inches or smaller. Sixteen (16) inch or larger valves may be low torque resilient wedge gate valves or butterfly valves. All valves sixteen (16) inches or larger shall have by-passes.

Pressure rating on valves shall be equal to or greater than the pressure rating of adjacent pipe.

All valve boxes shall be Type C, MAG Detail 391-1, with locking lids. All valves shall be installed with debris caps. The handle color shall be blue to indicate valve type. Acceptable manufacturer is SW Services or approved equal.

## H. **FITTINGS**

Capped dead end lines shall be tapped with a flushing device as per MAG Standard Detail 390, Type "B". Valves on dead end lines which may be extended should be provided with two full lengths of pipe between the valve and the plug for lines twelve (12) inches and larger and one full joint for lines smaller than twelve (12) inches. Blow-off valves, fire hydrants, or other suitable means shall be installed at the end of dead-end mains to allow periodic flushing of the lines. Flushing devices shall not be located in washes, detention / retention areas, sidewalks or driveways.

Air release valves shall be installed at all changes in slope of water transmission mains eight (8) inches or larger in diameter, as follows:

1. When water line changes from a positive slope to a zero slope in primary direction of flow.
2. When water line changes from a positive slope to a negative slope in primary direction of flow.
3. When water line changes from a zero slope to a negative slope in a primary direction of flow.
4. For vertical alignment changes to undercross or overcross another facility (i.e., utility, drainage washes, etc.), please refer to Item J (Culvert and Utility Crossings) in this section.

NOTE: Slopes less than or equal to 0.002 ft/ft shall be treated as zero slopes.

In the absence of any changes in slope, air release valves shall be installed not more than 2,640 feet apart.

All air release valves shall be a combination air / vacuum release type detail 2348 of the City of Scottsdale's Supplemental Standard Details.

No water line shall be deflected either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling without the appropriate use of bends or offsets. Fittings may be required where more than two pipe lengths are deflected.

Thrusts on pipelines with unrestrained joints occur wherever a bend or branch outlet exist. If the lengths of pipe are joined by tension joints, such as welded joints in a steel pipeline and lugged joints in concrete pipelines and cast-iron pipelines, other forms of anchorage may not be required. The determination of whether or not a given section of pipeline needs restrained joints or other means of anchorage shall be made by qualified professional engineer and approved by the City. All thrust anchorages shall be designed for a safety factor of not less than 1.50 under maximum pressure loading. Thrust blocks will not be allowed on the system. Joints will be restrained with restraining systems approved by the City's Water Operation Department and restraint length shall be submitted to the City's Project Review Department at the time of plan submittal.

All horizontal changes in direction in water lines shall be marked with an electronic marker. Valve locations permit adequate identification of pipeline location (typically at crosses and tees). Electronic markers shall be a self-leveling type and operate on a frequency of 145.7 kHz and detectable at a depth of four (4) feet. An electronic marker shall be placed at the center of all fittings at a depth of three (3) feet.

## I. **SERVICE LINES**

Water service lines and meters shall not be located in driveways, sidewalks, washes or retention / detention areas. Branch service tees are not allowed.

Installation of water service taps shall be in accordance with City of Scottsdale Detail No. 2330 and 2345. The water service(s) and meter(s) shall be sized based on the total demand placed upon the system by the developed parcel(s). For commercial developments, water used for irrigation shall be separately metered. Connection of two or more meters or services in a manifold configuration is prohibited. Water services lines shall be a one (1) inch minimum unless otherwise approved by the Water Operations Department.

Due to the City's water billing rate structure, meter sizes shall not exceed the size of the service (i.e. a one and one-half (1-1/2) inch meter will not be allowed on a one (1) inch service. Extra attention is recommended when sizing services for custom home lots where meter sizes often exceed one (1) inch.

Construction plans must indicate location of meter service lines and sewer taps to each unit referenced with stations and dimensions from the street center line or monument line. Location of sewer service relative to the water service shall also be shown.

No service connections or fire protection systems shall be made to water lines fourteen (14) inches or larger in diameter or to water lines designed solely to transmit water from one pressure zone to another pressure zone.

All galvanized iron and polyethylene water service lines is sizes three-quarter (3/4) inch through two (2) inch which are exposed during construction shall be replaced in their entirety with Type "K" copper tubing. This will include the replacement of iron service saddles with bronze saddles and the replacement of both the corporation stop and the meter stop in all cases.

In general, all water service lines shall be located within two (2) feet of the property line adjacent to adjoining parcels water service line, at the edge of right of way, perpendicular to the water main.

## J. CULVERT AND UTILITY CROSSINGS

For minimum clearance under culverts, storm drains and other utilities, please refer to City of Scottsdale Details #2370 and #2372. The crossing shall be constructed of Ductile Iron Pipe and shall not be deflected or swept. Air release valves and isolation valves shall be installed as per the following.

1. Isolation valves shall be installed on each side of the vertical realignment to minimize disruption of service should the crossing need to be isolated for maintenance or repair.
2. For dead-end water lines, air release and isolation valves will be required on both sides of the vertical realignment.
3. For all other applications, air release valves will be installed at a location calculated by the engineer to release any air trapped in the system.
4. Tees, service lines and other appurtenances shall not be located within the vertical realignment.
5. Special attention shall be given to vertical realignments on existing waterlines to avoid conflict with the distribution system. Vertical realignments over twenty-five (25) feet in length (bottom measurement) shall be constructed offset from the existing line and tested

per MAG and C.O.S. specifications prior to connection. All changes in direction shall be horizontal or vertical.

### K. SAMPLING STATIONS

Sampling stations are to be located in all new residential sub-divisions as determined by the City of Scottsdale Water Resource Department. Developments are required to contact the Water Quality Division at 480-312-8743 prior to Preliminary Plat submittal. The sampling stations are to be located mid-street, three (3) feet behind the sidewalk, on the property line, perpendicular to the R.O.W., and shall be located within the right-of-way. It shall be constructed per the City of Scottsdale Standard detail #2349 of the MAG supplemental specifications. A sampling station will be required for all platted subdivisions of twenty (20) dwelling units or more as determined by the Water Resource Department. One sampling station will be required for every three hundred (300) dwelling units or portion thereof. A large development constructed in phases will be required to install the sampling station on the first phase and each subsequent phase when the dwelling units for all phases constructed exceed 300 units. Manufacturer of these sampling stations shall be Koraleen or approved equal with a stainless steel ball valve.

### L. BACKFLOW PREVENTION AND CROSS CONNECTION CONTROL

To determine the requirements for backflow protection, please refer to the City of Scottsdale Ordinance No. 3117. For installation requirements, please refer to the most current set of City of Scottsdale Supplemental Standard Detail for Public Work Construction.

## 4-103 FIRE PROTECTION REQUIREMENTS

### A. FIRE FLOW REQUIREMENTS

Water distribution facilities shall be sized to deliver a minimum fire flow of one thousand five hundred (1,500) gallons per minute (gpm) to commercial, industrial and multifamily residential properties, one thousand (1,000) gpm for properties located in the county and a minimum of five hundred (500) gpm to one and two family dwelling unit residential properties. These fire flow requirements are based on the requirements of the City of Scottsdale Fire Code in fully sprinklered developments.

### B. HYDRANT LOCATIONS

The spacing of fire hydrants is to be measured along the street or roadway in which a fire hose would be laid. Generally, this spacing is measured along the curb line.

Fire hydrant locations shall be stipulated by the local authority, The following standards shall be used as guide:

1. The spacing of the fire hydrants in developments consisting of lots with single family residences on each lot shall be no more than one thousand two hundred (1,200) feet.
2. In commercial and multifamily developments, hydrants shall be spaces a maximum of seven hundred (700) feet apart for the entire perimeter of the development.
3. The spacing of the fire hydrants in the county shall be no more than six hundred (600) feet.

4. Two-way, reflective blue raised pavement markers must be provided to identify the location of the fire hydrants, in accordance with the information in figure 4-7. These markers are readily available from businesses providing highway marker materials.
5. Dead-end lines one thousand (1,000) feet or less may be six (6) inch minimum diameter provided adequate pressure and flow rates are maintained.
6. Dead-end lines shall not be longer than 1,200 feet in length.
7. Fire hydrant runs or fire lines shall not be utilized for sprinkler service.
8. Auxiliary fire hydrant valves must be connected to the main water line by flanged tee.

Please contact Rural Metro for any Fire requirements.

## C. **FIRE LINES**

Location of on-site fire lines and taps should be determined by the site relationship of the fire department connection, riser location, emergency access and fire hydrant locations. Size of fire lines shall be determined by City design criteria and flow test data provided by the engineer for the design of the project. Fire systems must include a back flow prevention device.

Four (4) blueline print sets of plans for on-site fire lines, including the back flow prevention device, shall be submitted to the fire protection authority for review and approval prior to installation. Design shall be based on a flow test as per section 4-103.A of this manual, but may be submitted after permit is issued. The drawings shall be of uniform size (24-inch by 36-inch) and shall be drawn to scale. One set of the approved civil water plans shall accompany this submittal.. Applicable City of Scottsdale and NFPA construction notes shall also be included on the working drawings.

Installation will be per approved working plans. Any deviation from approved plans will require written permission of the authority having jurisdiction.

Inspections will be per NFPA 24 and as may be required by the local fire protection authority.

Fire lines will not be connected to transmission mains that are 14 inches or larger.

## D. **AUXILIARY STORAGE TANKS**

Pressures and discharge flows required by Rural-Metro Corporation will be for a minimum of two (2) hours for commercial projects and may require a fire pump package installation when the building's construction type, occupancy fire load commodities' classification, volumetric building areas, building height and individual square footage areas per floor level produce a pressurized fire flow demand in excess of the water transmission mains capabilities.

For residential storage requirements see Section 4-100.A, ordinance requirements.

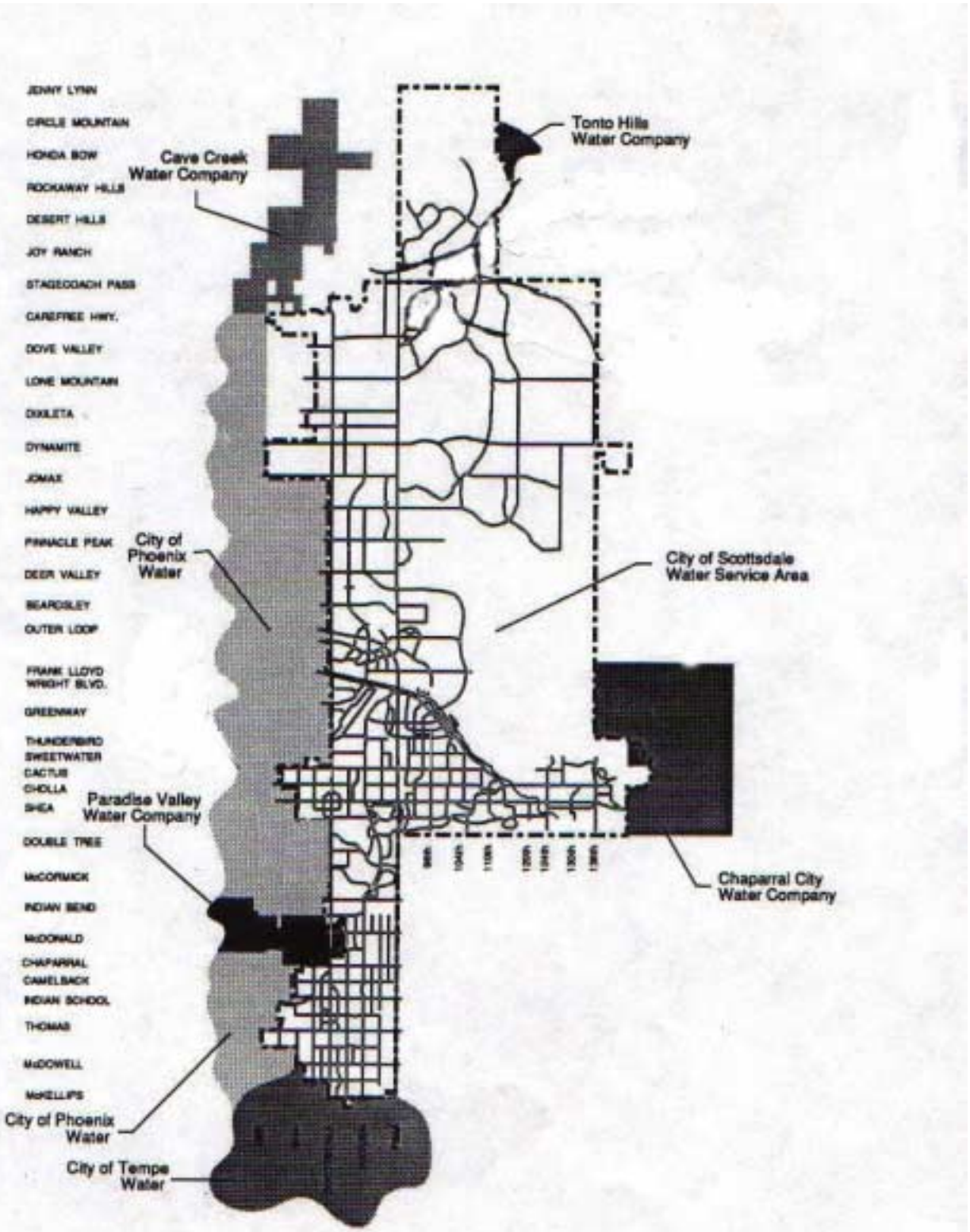
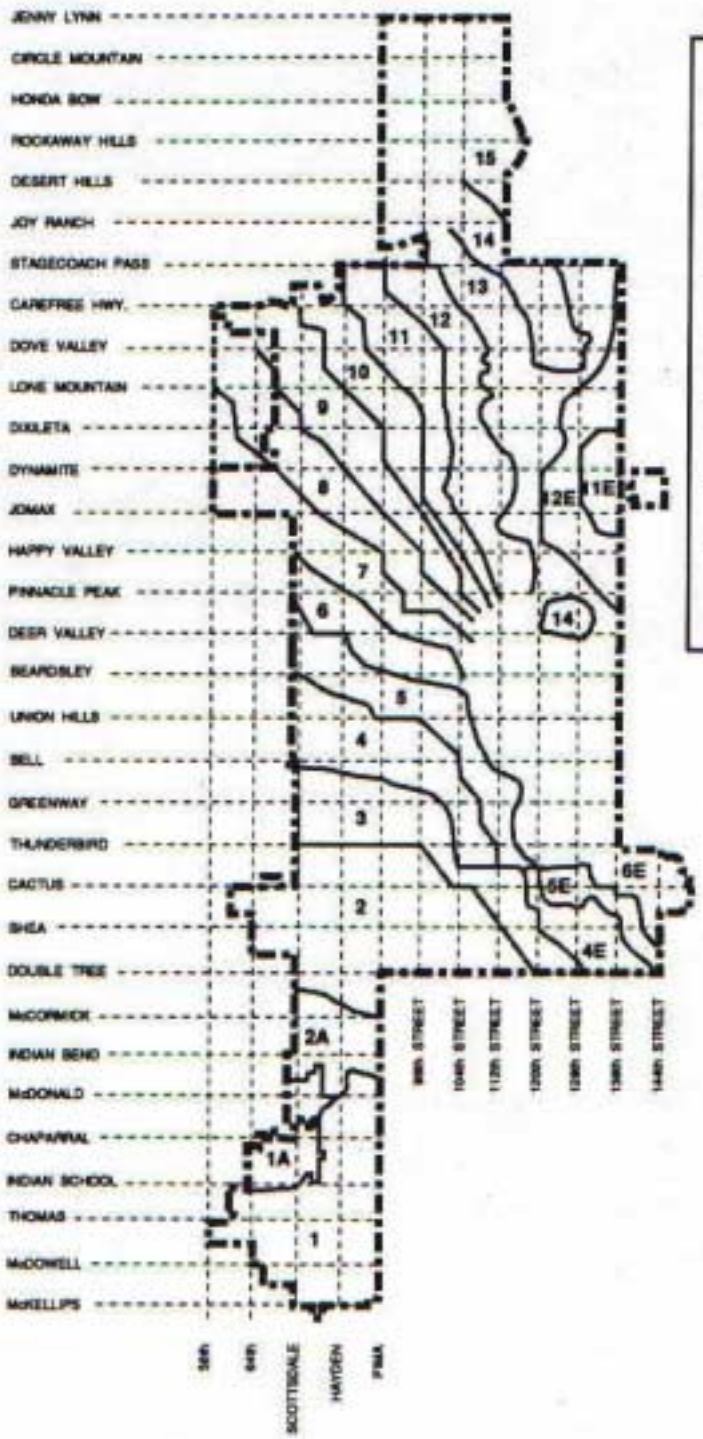



**FIGURE 4.1-1**
Map of Water Service Areas - March 1994




| Zone | Ground Elevation Range (FL) |
|---|---|
| 1 | 1180 - 1280 |
| 1A | 1250 - 1330 |
| 2A | 1280 - 1330 |
| 2 | 1330 - 1440 |
| 3 | 1440 - 1550 |
| 4 | 1510 - 1650 |
| 4E | 1550 - 1650 |
| 5 | 1650 - 1790 |
| 5E | 1650 - 1750 |
| 6 | 1790 - 1920 |
| 6E | 1750 - 1934 |
| 7 | 1920 - 2050 |
| 7E | 1934 - 2065 |
| 8 | 2050 - 2180 |
| 8E | 2065 - 2200 |
| 9 | 2180 - 2310 |
| 10 | 2310 - 2440 |
| 11, 11E | 2440 - 2570 |
| 12, 12E | 2570 - 2700 |
| 13 | 2700 - 2830 |
| 14 | 2830 - 2960 |

**FIGURE 4.1-2**
Pressure Zone Map

## Average Day Water Demand Per Dwelling Unit in GPD[†]

| Land Use | Inside Use | Outside Use | Total Use |
|---|---|---|---|
| Residential < 2 DU per acre | 208.90 | 276.70 | 485.60 |
| Residential 2 - 3.99 DU per acre | 193.70 | 276.70 | 470.50 |
| Residential 3 - 7.99 DU per acre | 175.90 | 72.30 | 248.20 |
| Residential 8 - 11.99 DU per acre | 155.30 | 72.30 | 227.60 |
| Residential 12 - 22 DU per acre | 155.30 | 72.30 | 227.60 |
| Resort Hotel (per room) | 401.70 | 44.60 | 446.40 |
| Resort Hotel Low Intensity (per room) | 401.70 | 35.70 | 437.40 |
| Commercial (per square foot) | 0.75 | 0.11 | 0.90[††] |
| Cultural/Institutional (per acre) | 669.50 | 669.50 | 1339.10 |
| Office (per square foot) | 0.50 | 0.075 | 0.60[††] |
| Industrial (per acre) | 873.10 | 154.40 | 1027.50 |
| Utility (per acre) | 0.00 | 1785.40 | 1785.40 |
| Open Natural (per acre) | 0.00 | 0.00 | 0.00 |
| Open Developed (per acre) | 0.00 | 1785.40 | 1785.40 |
| Open Golf (per acre) | 0.00 | 4285.00 | 4285.00 |

[†]City of Scottsdale Water Supply - Distribution Mast Plan, June 1987, Prepared by NBS/Lowry Engineers & Planners.

[††]City of Phoenix Memorandum Water Demand and Wastewater Flow Generation Rates, April 1985.

# FIGURE 4.1-3
Average Day Water Demand Per Dwelling Unit in GPD